

Smart Building -to- Smart Grid

Maximizing LONWORKS open systems
and the Smart Grid



What is it? What's your perspective?

- The Utility:
 - Reliability; Cost Savings; Customer Service
- The Aggregator:
 - Profit Center; Facilitator; Assistant
- The End-User:
 - Reliability; Cost Savings; Customer Service

Communications: Points Between

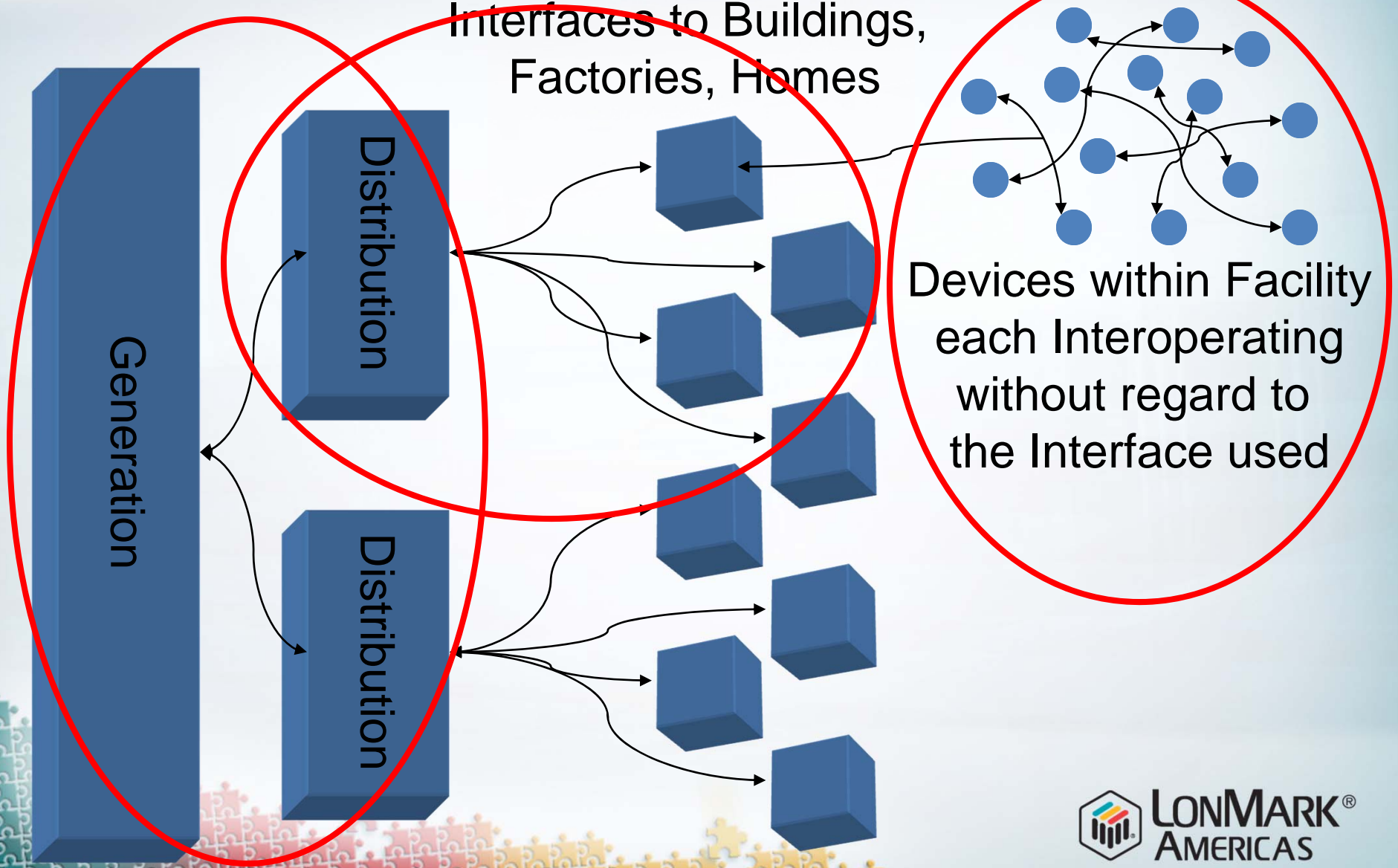
- Generation-Company Equipment
 - Within a single facility
 - Spanning facilities
 - Two complementary companies
- Distribution Equipment
 - Billing
 - Monitoring
 - Control
- End Devices
 - Thermostats
 - Appliances / Equipment
 - Energy-Reduction Programs
 - Customer Acceptance
 - Critical Needs
 - Non-Critical Loads
 - Balancing of Consumption
 - Integration of Solar, Wind, ...

Communications: Points Between

- Demarcation Points
 - In/Out:
 - Meter at the outside of the building/house
 - In/Out:
 - In-home Internet gateway (DSL, cable, fiber, satellite, cellular)
 - In/“Out”:
 - In-home TV/Radio reception (broadcast, cable, fiber, satellite, AM/FM)
- Data being Shared
 - Out: Automated Meter Reading
 - Out: Outage Detection
 - In: Remote Disconnect
 - In: Rate-Tier Information
 - In: Maintenance Schedules
 - In: Emergency Notification
 - In: Billing Information

Paths and Their Protocols

Interfaces to Buildings,
Factories, Homes



Smart Grid Interoperability Panel

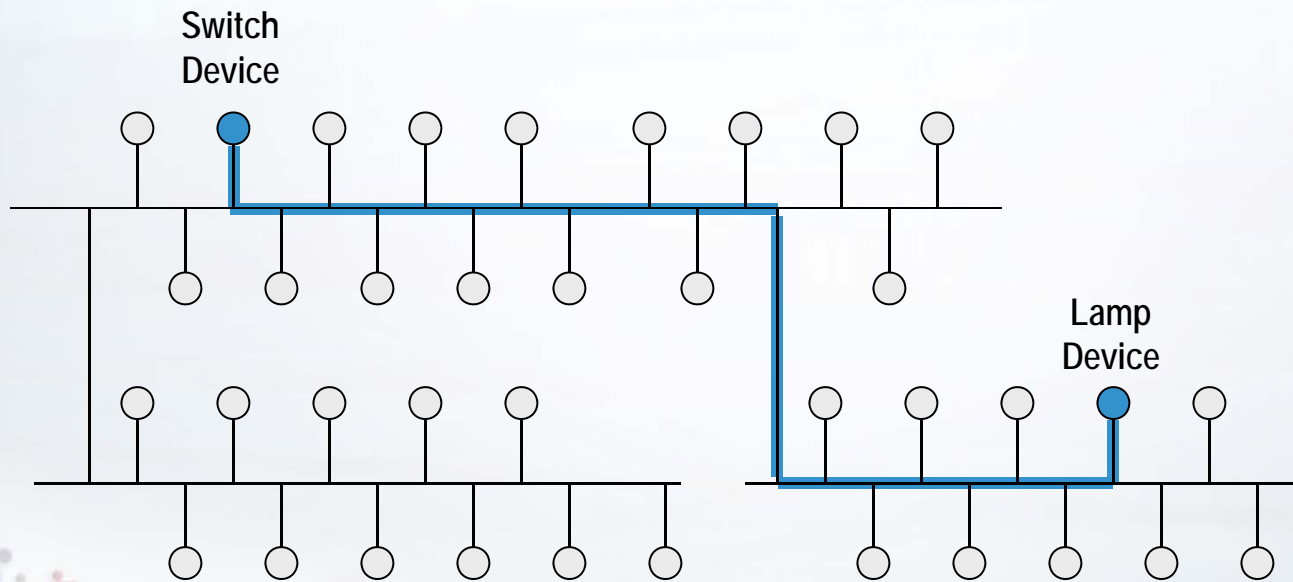
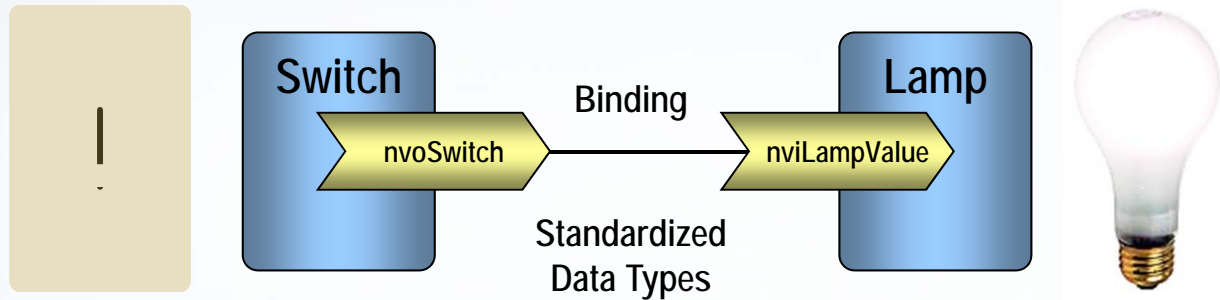
Priority Action Plans (PAPs) participation:

- 03 - Common Price Communication Model
 - 04 - Common Scheduling Mechanism
 - 09 - Standard Demand-Response Signals
 - 10 - Standard Energy Usage Information (*closing...*)
 - 11 - Common Object Models for Electric Transportation (*forking...*)
 - 15 - Harmonize PLC Standards for Appliances Comms in the Home
 - 16 - Wind Plant Communications
 - 17 - Facility Smart Grid Information Standard
- Domain Experts Working Groups (DEWGs):
 - B2G, V2G, & watching CyberSecurity, I2G, and H2G

LonMark International Task Groups

- Automated Food Service
- Fire & Smoke
- Network Tools
- Refrigeration
- Industrial / Semicon Fab
- Lighting
- HVAC & BAS
- Home (Appliances, A/V)
- Safety (intrinsic, SILs)
- Security (facility)
- Services (SATO)
- Sunblinds/Weather
- System Integration
- Elevator/Escalator
- Transportation
- Utility/Energy

LONMARK Profile Concept



LONMARK Energy Information

- Distributed Energy Resources:
 - Wind-Turbine Generation (~ 2011Q1)
 - to enable micro-generation and autonomous farms.
 - being mapped to fit IEC 61400-25 (macro-generation) to allow for interfacing micro-gen to a macro-gen -wind grid.
 - Photovoltaic Generation (~ 2011Q2)
 - following similar effort of the Wind-Turbine efforts, above.
 - will map to effort of groups like SunSpec and others.

LONMARK Energy Information

- Energy Monitoring and Reduction:
 - Thermostat (1996)
 - heat/cool/fan thermostat with local and/or remote sensors.
 - Temperature Sensor (1996)
 - variable hysteresis-sensd, 0.01 C resolution.
 - Space Comfort Control Command Module (1998)
 - can provide for direct load control of HVAC by interaction to the input of the HVAC system (not by cutting power).
 - Constant Light Controller
 - to maintain a constant lighting level while reducing lighting energy when ambient light is sufficient.
 - for use with hardwired or networked light/lux sensors.

LONMARK Energy Information

- Energy Monitoring and Reduction:
 - Light Sensor (1997)
 - light-level measurement in lux.
 - Outdoor Luminair Controller (2009)
 - allows for intelligent energy reduction and outage detection for streetlamps and luminaires in parking lots and garages.
 - Global Solar Radiation Sensor (next: Board Vote)
 - to measure W/m^2 of radiated energy over a surface.
 - Completing voting round by the Technical Advisory Committee;
 - Next: on to the Board of Directors.

LONMARK Energy Information

- Energy Monitoring and Reduction:
 - Demand-Response Load Control...
 - » What a Utility should do?
 - » What a Facility should do?
 - » Two-Way interaction or One-Way?
 - » Contracts or Best Effort?
 - » Curtailment only or Sell Back?

Demand-Response Load Control?

Scenario: "It's 3:20pm on a Wednesday."

Energy cost will be "very high" from 4 to 5pm.

How much can you Reduce?

Whoa, "very high" is too much for A/C and Storage.

Let me check my systems...

Demand-Response Load Control?

Systems:

- Temperatures of all rooms within parameters; low W/m² on southern side, partly cloudy, no percip.: temperatures will hold for 1h 17m estimated if fans at 35%.

Fans at 35% require xyz kW to run.

- Batteries at 97%: can run 70% of lights for the 1 hour at 90% (minimum demand to low natural light present).

30% of lights requires wxy kW to run.

I can give you a reduction of abc kW for the 'very high' period.

OK, thanks.

LONMARK Energy Information

- Energy Monitoring and Reduction:
 - Demand-Response Load Control (~ 2011Q4)
 - will implement the results of the SGIP's PAPs 3, 4, 9, 10 and/or 17 (*i.e.*, the interfaces of ASHRAE/NEMA SPC201).
 - this effort is at skeleton stage (simple draft) until further SGIP progress.

LONMARK Energy Information

- Bidirectional Electricity Flows:
 - Generator Set (1998, revision ~ 2011Q1)
 - being revised for wider-range of generators (like DER).
 - will allow for wind, solar, etc.
 - Transfer Switch (1999, revision ~ 2011Q2)
 - used to monitor and automatically connect the best of two power sources to an electrical load.
 - being revised to allow for DER reverse flow of energy and multiple power sources; either in exclusivity or in aggregate.

LONMARK Energy Information

- Metering:
 - Utility Data Logger Register (1998)
 - used to collect measuring information through register objects:
 - energy, maximum demand, volume of flow, energy/demand series, etc.
 - Utility Meter (2005)
 - automated meter reading:
 - such as electricity, water, and heat meters
 - Smart Electric Meter (~ 2011Q1)
 - Specifically for electricity metering:
 - *Basic Meter* – *Sub Meter* – *Utility Meter*

LONMARK Energy Information

- Smart Electric Meter : *Utility Meter*
 - Meter Status, Requests, etc.
 - Instant/Average Voltages
 - Totals per Price Tier
 - Phase Voltage Differentials (LL/LN)
 - Instant/Average Current
 - Instant/Average Frequency
 - Average Power Factor
 - Present and Historical values:
 - Total/Max/Phase Active Power
 - Total/Max/Phase Reactive Power
 - Total/Max/Phase Apparent Power

Completed Functional Profiles

- Air Velocity Sensor
- Analog input
- Analog output
- Audible Fire Indicator
- Automatic Transfer Switch
- Boiler Controller
- Calendar
- Channel Continuity Monitor
- Channel Monitor
- Chilled Ceiling
- Chiller
- Closed-Loop Actuator
- Closed-Loop Sensor
- Clothes Washer, Domestic
- CO2 Sensor
- Constant Light Controller
- Damper Actuator
- Data Logger
- Device Monitor
- Discharge Air Controller
- Elevator/Lift Arrival Gong
- Elevator/Lift Car-Direction Lantern
- Elevator/Lift Fire-Systems Port
- Elevator/Lift Hall Lantern
- Elevator/Lift Position Indicator and Message Display
- Elevator/Lift Voice Announcer
- Entry/Exit
- Fan Coil Controller
- Fire Smoke Damper Actuator
- Frost Sensor
- Generator Set
- Heat Pump with Temperature Control
- Identifier Sensor
- ISI Keypad
- ISI Lamp Actuator
- Lamp Actuator
- Light Sensor
- Modem Controller
- Node Object
- Occupancy Controller
- Occupancy Sensor
- Open-Loop Actuator
- Open-Loop Sensor
- Outdoor Luminair Controller
- Panel Controller
- Partition Wall Controller
- Pressure Sensor
- Pull Station Fire Initiator
- Pump
- Rain Sensor
- Real Time Based Scheduler
- Real Time Keeper
- Refrigerated Display Case : Defrost
- Refrigerated Display Case : Evaporator Control
- Refrigerated Display Case : Thermostat
- Relative Humidity Sensor
- Roof Top Unit Controller
- Scene Controller
- Scene Panel
- Scheduler
- Smoke (Conventional) Fire Initiator
- Smoke (Intelligent) Fire Initiator
- Space Comfort Control Command
- Space Comfort Controller
- Static Programmable Device
- Sunblind Actuator
- Sunblind Controller
- Switch
- Telephone Directory
- Temperature Sensor
- Thermal Fire Initiator
- Thermostat
- Unit Ventilator Controller
- Universal Fire
- Universal Fire Initiator
- Utility Data Logger Register
- Utility Meter
- Valve Positioner
- Variable Speed Motor Drive
- VAV Controller
- Visible Fire Indicator

Smart Building -to- Smart Grid

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